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(54) MULTIMEDIA EQUIPMENT CONTROL DEVICE BY DETECTION OF SKIN TEMPERATURE

(57)Abstract:

PURPOSE: To control equipment on the basis of various data collected from the body surface of a testee.

CONSTITUTION: This device is formed of a skin temperature detecting means 2 for detecting a skin temperature such as the finger top of a testeean evaluating means 5 for analyzing the detected skin temperature and evaluating a human sense such as the physical and mental strain of the testeeand a multimedia control part 3 for sending a control signal to multimedia equipment 9 on the basis of the evaluation result of the evaluating means 5. The multimedia control part 3 controlsparticularlythe image or sound of the multimedia equipment 9 on the basis of the sense evaluation result.

CLAIMS

[Claim(s)]

[Claim 1]A multimedia apparatus control device characterized by comprising the following by detection of skin temperature.

A skin temperature detection means to detect skin temperaturesuch as a test subject's fingertip.

Evaluation methods which analyze detected skin temperature and evaluate feeling

of personssuch as a feeling of tension of this test subject's mind and body.
A multimedia control section which sends a control signal to multimedia apparatus based on an evaluation result of these evaluation methods.

[Claim 2]A multimedia apparatus control device by detection of the skin temperature according to claim 1wherein said multimedia control section controls a picture or sound of said multimedia apparatus based on said sensuous evaluation result.

[Claim 3]Form a skin temperature detection means in a final controlling element of apparatusand A skin temperature entry-of-data partMultimedia apparatus providing analyzing parts of the dataand said input dataa storage parts store of an analysis result and an image acoustic control part in a control section of apparatusand controlling an image and sound by operation information on an evaluation value obtained from an analysis result of said data by evaluating people's feelingand said final controlling element.

[Claim 4]A skin temperature entry-of-data part which formed a skin temperature detection means in a microphoneand was measuredMultimedia apparatus providing analyzing parts of the dataand a storage parts store and an indoor acoustic control part of said input data and an analysis result in a control section of apparatusand controlling interior illumination and sound based on an evaluation value obtained from an analysis result of said data by evaluating people's feeling.

[Claim 5]The multimedia apparatus according to claim 3 or 4 characterized by computing at least one parameter in a skin temperature differencea power spectrumthe maximum rear PUNOFU indexor KS entropy as analysis of said skin temperature data.

[Claim 6]The multimedia apparatus according to claim 5 considering it as a skin temperature difference with a difference with skin temperaturesuch as fingertip skin temperaturea palmor a shellwhen computing said skin temperature difference.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the method of controlling multimedia apparatussuch as a game machineusing the skin temperature detected from the test subject's body surface.

[0002]

[Description of the Prior Art]"JPH6-9546B A test subject's pulse and/or electrocardio sensor with which a body surface can be equippedThe pattern of pulse wave and/or electrocardio waveform which were extracted by the above-mentioned sensor are digitized with an A/D converterThe calculating means which projects the chaos attractor embedded in the number space which is the virtual space which began to make the discrete data which is the digitized figure from

mathematical operation with how to embed TAKENSU on two-dimensional number space. The calculating means which computes the rear PUNOFU index which is the numerical value which showed as the index the grade of the sharp dependency over the initial value which is one of the features of chaos from the above-mentioned chaos attractor diagnostic equipment possessing the displaying means which displays the above-mentioned rear PUNOFU index, and the memory measure which memorizes the above-mentioned discrete data and/or a rear PUNOFU index is indicated.

[0003]

[Problem(s) to be Solved by the Invention] However, there is no technical idea that development of the electrical and electric equipment and/or electronic equipment which matched sensibility will be given to people using the above-mentioned diagnostic result in a noncommercial electric appliance and industrial use apparatus now.

[0004] Then, an object of this invention is to control apparatus based on the various data extracted from a test subject's body surface.

[0005]

[Means for Solving the Problem] A skin temperature detection means by which this invention detects skin temperature, such as a test subject's fingertip, Evaluation methods which analyze detected skin temperature and evaluate feeling of persons, such as a feeling of tension of this test subject's mind and body, Consisting of a multimedia control section which sends a control signal to multimedia apparatus based on an evaluation result of these evaluation methods, said multimedia control section controls a picture or sound of said multimedia apparatus based on said evaluation result especially.

[0006]

[Function] In the above-mentioned composition, the analysis of the skin temperature from which feelings, such as a test subject's feeling of tension, were detected shows, and the apparatus according to feelings, such as this test subject's feeling of tension, is controlled based on this.

[0007] For example, in the case of a game machine, when a test subject is turgescence, difficulty is lowered, and in it, image sound of raising difficulty in a relaxed state conversely is controlled. For example, in the case of a karaoke room, a singer's feeling of tension and the degree of agitation are made into a numerical value, and it is made to display them on a monitor. When a singer's feeling of tension is high, a singer's feeling of tension is softened by making interior illumination gay and controlling it.

[0008]

[Example]

[Principle] The principle of presumption of the sensation amount by the chaos analysis of the skin temperature first used by this invention is explained.

[0009] Chaos analysis occurs as one analytic method which evaluates nonlinearity like change of skin temperature.

[0010]

[Equation 1]

[0011]The locus of the solution of an equation with one above serves as complicated time series data like the thick curve (at initial value = the time of 0.506127) shown in drawing 5. The way of thinking of the chaos whether the comparatively simple mechanism which generates non-linearity exists behind the apparently random phenomenon observed from such a nature and a living body is brought about.

[0012]As a feature of a mechanism of generating this chaosorbital instabilitylong-term forecast impossible natureand self similarity can be mentioned. By the waysince the equation of said one number is a deterministic equationif an initial value is givenit will be determined thoroughly in the future. Howeverwhen the orbit of the solution of this equation changes an initial valueit will become a completely different thing.

[0013]For examplewhen the initial value 0.506 is given to several 1it turns out that **** which is completely different from the middle as the thin curve of drawing 5 shows the locus of a solution is shown. Thusin the mechanism which generates chaosit has a sharp dependency over an initial valueand orbital instabilityand has long-term forecast impossible nature as an initial value.

[0014]These features are the features which can be respectively evaluated by a rear PUNOFU (Lyapunov) index and KS entropy. The technique of presuming the flexibility (correlation dimension) of the mechanism which generates chaos from the geometric self similarity of the orbit of a solution as shown in said drawing 5 is also proposed.

[0015]In producing this inventionthe skin temperature of the fingertip in the state at the time of the relaxation at the time of summer clothes or winter-clothes wear or stress (at the time of a quiet closed eye) (at the time of TV game) was measured for six test subjects (NO.1-6).

[0016]And chaos analysis was conducted in order to evaluate a nonlinear change of the fingertip skin temperature fluctuation in each of these states. What made the table hereafter the maximum rear PUNOFU index which obtained by conducting rear PUNOFU spectrum analysis in time lag $\tau=3$ and embedding dimension $=5$ and the value of KS entropy is shown in Table 1 - 4.

[0017]

[Table 1]

[0018]

[Table 2]

[0019]

[Table 3]

[0020]

[Table 4]

[0021]What furthermore graph-ized said tables 1-4 is shown in drawing 6 - 9. As for these results the tendency which the maximum rear PUNOFU index or KS entropy increases by statistically intentionally ($P < 0.01$) at the time of a relaxation was observed. P is the abbreviation for Probability and points out the probability of significance and it means here that the probability whose presumption is not significant is less than 1% in $P < 0.01$.

[0022]To said six test subjects the self-assessment value data of the feeling of the shape of a continuation measure of a relaxation (-100) and stress (100) is taken to drawing 10 and drawing 11 and what graph-ized this the maximum rear PUNOFU index and KS entropy is shown in them. It turns out that the feeling of a relaxation and stress can be statistically presumed intentionally ($P < 0.05$) between the maximum rear PUNOFU index or KS entropy from this result.

[0023][Example] next one working example of the multimedia apparatus by detection of the skin temperature of this invention controlled are described in detail based on Drawings.

[0024]Drawing 1 is a block diagram showing the composition of the game machine as multimedia apparatus. the skin temperature sensor 2 for 1 being a multimedia final controlling element as a controller of a game machine and measuring skin temperature from a finger in the figure-- attachment *****.

[0025]3 is a multimedia control section and consists of the picture acoustic control part 4 the skin temperature analyzing parts 5 the data storage part 6 the skin temperature input part 7 and the operation information input part 8. 9 is a monitor which outputs an image and sound based on the control signal from said multimedia control section.

[0026]The operation in this composition is explained below.

Step 1 : The attached skin temperature sensor 2 (for example a copper constantan consists of a thermo couple or a thermo sensitive register) is used for the multimedia final controlling element 1 The skin temperature of the fingertip at the time of the quiet closed eye in front of a game is measured and the skin temperature average is memorized to the data storage part (memory) 6 in the multimedia control section 3.

[0027]Step 2: Measure the skin temperature of a fingertip by the skin temperature sensor 2 which was attached to the multimedia final controlling element 1 during game execution. It is good to it also considering the skin temperature difference as a request skin temperature difference to measure simultaneously skin temperatures such as the back of not only fingertip skin temperature but a hand during game execution.

[0028]Step 3 : The measured skin temperature is inputted into the skin

temperature analyzing parts 5 in the multimedia control section 3
Skin temperature the skin temperature difference of the time of the quiet closed eye measured beforehand and the inside of a game the maximum rear PUNOFU index explained by the way and KS entropy of a principle or at least one parameter in the power spectrum obtained as a result of frequency analysis is computed here.

[0029] Step 4: Compute the sensuous evaluation value of a game player called a feeling of tension based on the following several 2-6 from the parameter computed at said step 3.

[0030]

[Equation 2]

[0031]

[Equation 3]

[0032]

[Equation 4]

[0033]

[Equation 5]

[0034]

[Equation 6]

[0035] By two above - a six numbers feeling of tension is computed by -100 - +100 and the state which relaxes -100 most the state where +100 becomes it tense most and the state where 0 is not which [these] either are shown.

[0036] the state (5) which is carrying out the dramatically tense state and aforementioned-state (3) state (4) relaxation which is carrying out (1) (2) stress and which is not which either by dividing the between to 100-+100 into five for example -- the state relaxed dramatically -- as -- a case -- dividing -- things -- being possible .

[0037] Step 5: The computed sensuous evaluation value (the degree 1 of said feeling of tension - 5 grades) is handed over by the image acoustic control part 4 with the operation information from the multimedia final controlling element 1 and control of the image by the monitor 9 and sound is performed by instructions of this control section 4. Said sensuous evaluation value is displayed on a monitor.

[0038] [Verification] Measurement Division analysis of the skin temperature of the fingertip at the time of a relaxation and stress (quiet closed eye) (under game use) is conducted by 24 test subjects A skin temperature absolute value a skin

temperature difference the maximum rear PUNOFU index obtained as a result of chaos analysis and KS entropy were computed and correlation with a test subject's subjectivity reported value and a computed value was investigated from a viewpoint of between stress and the degree of agitation. The result is shown in Table 5.

[0039]

[Table 5]

[0040] If this table 5 is seen a thing with high (significant ($P < 0.05$) correlation exists statistically) correlation between a skin temperature difference the maximum rear PUNOFU index KS entropy and the feeling of a feeling of tension and the degree of agitation is understood so that clearly.

[0041] The place which created the multiple regression expression which furthermore presumes the feeling of a feeling of tension and the degree of agitation using these four parameters and investigated correlation The high multiple correlation coefficient which a feeling of tension calls it R (correlation coefficient) = 0.698 (refer to drawing 2) and calls the degree of agitation $R = 0.713$ (refer to drawing 3) was shown and it was verified that these feelings can be presumed with high precision. A multiple correlation coefficient points out the correlation coefficient of a point estimate and an observed value here and it is used as an index which looks at goodness of fit (applied goodness).

[0042] When frequency analysis was performed to the measurement data of a test subject's skin temperature drawing 4 (a) and (b) was obtained. In the figure a vertical axis is a power spectrum and a horizontal axis is frequency. When these figures are seen signs that the power spectrum 0.2 Hz or near 0.4 Hz changes at the time of a relaxation or stress are known.

[0043] This shows that the power spectrum 0.4 Hz and near 0.2 Hz is effective in presumption of the feeling of a feeling of tension or the degree of agitation.

[0044]

[Effect of the Invention] The following effects are expectable by this invention.

(1) For example when a game player operates a manual operation button and operates the displayed drive course in a game like a driving simulator Conduct Measurement Division analysis of the skin temperature of the fingertip of a player and always monitor tonus and if tonus is high image sound will be changed to the course in which difficulty is low It becomes possible to change the game composition for which it was suitable according to the state at that time of a player as image sound will be changed to the course in which difficulty is high if tonus is low and a relax degree is high.

(2) For example a singer's feeling of tension and the degree of agitation can serve as a numerical value it can be made to be able to display on a display and a singer can be made to know the state at that time in the case of a karaoke room. When a singer's feeling of tension is high interior illumination can be made gay and a

singer's feeling of tension can also be softened.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a block diagram showing the composition of the multimedia apparatus of this invention.

[Drawing 2] It is a figure showing correlation with the self-assessment value of the feeling of tonus and the point estimate by this invention.

[Drawing 3] It is a figure showing correlation with the self-assessment value of the feeling of the degree of agitation and the point estimate by this invention.

[Drawing 4] (a) and (b) are the figures showing the power spectrum of the skin temperature data at the time of a relaxation and stress respectively.

[Drawing 5] It is a figure showing the locus of the solution of the formula of general chaos.

[Drawing 6] It is a graph which shows the rear PUNOFU index at the time of summer-clothes wear created from the data of Tables 1-4.

[Drawing 7] It is a graph which shows the rear PUNOFU index at the time of winter-clothes wear created from the data of Tables 1-4.

[Drawing 8] It is a graph which shows KS entropy at the time of summer-clothes wear created from the data of Tables 1-4.

[Drawing 9] It is a graph which shows KS entropy at the time of winter-clothes wear created from the data of Tables 1-4.

[Drawing 10] It is a figure showing correlation with the self-assessment value of a rear PUNOFU index and a point estimate.

[Drawing 11] It is a figure showing correlation with the self-assessment value of KS entropy and a point estimate.

[Description of Notations]

- 1 Multimedia final controlling element
 - 2 Skin temperature sensor
 - 3 Multimedia control section
 - 4 Image acoustic control part
 - 5 Skin temperature analyzing parts (evaluation methods)
 - 6 Data storage part
 - 7 Skin temperature input part
 - 8 Operation information input part
 - 9 Monitor
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